Technology, Education and Employment for Development

Report of a Technical Workshop
on
Science, Technology and Education Research
in
East and Central Africa.

29 - 31 August 1983, Nairobi.

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Workshop Report
Technology, Education and Employment for Development*
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Introduction

This workshop was organised around the assumption that there was research about to start in many parts of the region which could more profitably be conducted in the knowledge of related work in nearby countries. As a consequence it was thought that researchers about to conduct work on one particular aspect of work that linked science and technology with education could profit from exposing their methodology and conceptual approaches to other researchers in the field. This was not principally to improve researchers' information about who was doing what in Kenya, Zimbabwe or Somalia but rather to exchange views about how best to acquire good research data on a set of issues that would appear to cut across much of the research being proposed.

2. At the centre of the discussion about science, technology and education are a series of inter-related concerns about adoption, adaptation, utilisation, dissemination and creativity. Whether the particular issue is the impact of science education or the process of technical change in small industry, or, again, the calculation of whether a country requires more 'technicians', the debate is never far removed from these themes we have mentioned. Nor are these researchers' questions only; leaders in policy positions are also concerned. Indeed, during the course of the seminar, the Governor of the Central Bank of Kenya speaking in Zimbabwe alleged that many highly qualified staff in agricultural

* Hereafter TEED.

organisations were not performing their specialist functions but were merely engaged in non-specialist administrative duties.

Others need little prompting to make comments about 'mismatch', - not in the old sense of too many educated people chasing too few jobs, but too few people trained as scientists, vets, or technologists actually working in those scientific careers. A good deal of the research that was discussed or proposed under the different headings of the seminar emphasised the need to know much more about the evidence for these and many other statements on the utilisation of scientifically trained manpower. It may be useful accordingly to rehearse some of the commonalities at the thematic level, as well as some technical and methodological problems that accompany these questions.

3. Science, Technology and Training in the Informal Sector

In the research proposed for Uganda and Zimbabwe, there were several examples of the seminar exploring aspects of these common concerns. First, compared with the worry about non-utilisation of expensively gained knowledge and skill alluded to by the Kenyan banker, there is a quite different assumption by many approaching informal sector producers. It is a feeling that the sector could profit from a heavy dose of science or of theory. Allegedly, the sector suffers from being too practical, and its consequent lack of innovation derives from insufficient science-based knowledge. Hence it is tempting to recommend how informal operators can get access to the theory of their trade. Such concerns about the need for theory,

or for access to loans underline the tendency (amongst policymakers and researchers) to regard the informal sector's problems as deriving from its distance from the formal sector's education or technology system. As a consequence, schemes are often devised to co-opt, strengthen, integrate the informal with the formal sector, without asking first about the nature and determinants of the training and technology already being deployed by informal sector operators. There are a prior set of education and technology questions to be asked before suggesting schemes for co-option.

4. One of the principal questions raised by the seminar in this respect concerned the relationship between primary school and the informal sector, and, more particularly, between the exposure to primary science in school and any impact in the workplace thereafter. It was acknowledged that very little information was available in this area, but since many of the reforms in African primary science have been directed at practical experimentation in agriculture and the environment, there was good reason to examine whether the reforms had any consequences for post-primary self-employment. Research on post-school impact is notoriously difficult to do, but it may still be worth attempting. For example, some allied work on the impact of primary school on informal sector productivity (in Peru) is being pursued by the Education Department of the World Bank. In countries such as Tanzania where primary school is effectively terminal for more than 95% of the Std. VII cohort, it could be even more critical to know the potential contribution of relevant primary science, and, more generally, primary school knowledge.

5. Questions relating to the technology of the informal sector have also been insufficiently addressed. What tools and equipment are involved? How have these been changing over the last ten years? Has product diversification been evident within particular trades? Paradoxically, we do now know a great deal more about the technology and efficiency of the simple wood or charcoal burning jiko (brazier for cooking) which until recently was exclusively made by informal sector artisans. But the new research interest in the technology of the jiko has derived from donor agency concerns about renewable energy, afforestation,and related policies. Consequently, the most dramatic set of experiments with informal sector technology have come about as a result of formal sector involvement: jikos with clay liners, with water heaters attached, with new fuels based on coffee waste. Suddenly there is a proliferation of new styles, some linked to particular donor agency funding, others the result of local researchers or engineers being encouraged to give attention to what was once a completely neglected topic. This agency-led technological change offers the possibility of studying the dissemination and transfer of these more efficient technologies into rural areas. But there are other levels of study less dependent on externally-influenced change. In Uganda, for example, allegedly a great deal of originally formal sector technology was ransacked from Asian factories and workshops and now finds itself being operated in the informal sector. Although the politics of this particular technology transfer are unique, it could nevertheless be important for any Ugandan informal sector survey to bear this factor in mind. The popular image of formerly Asian-owned factories lying idle for lack of entrepreneurs, spare parts and fuel may need a little readjustment

in the light of such research.

Some technical aspects of research on the informal sector were underlined at the meeting. Can research on the informal sector be approached with instruments similar to what might be used in a survey of larger scale registered industry? If the training in the informal sector workshops is fundamentally on-the-job, and involves no formal teaching/training sessions, what kind of question can be asked about the organisation of training? Educators are used to conceptualising research questions in terms of training styles, distinction between education and training, between theory and practice, and to thinking in terms of periods, hours, modules, subjects, grading and certification. Any questionnaire which transfers these preoccupations of the formal education system to the analysis of low cost on-the-job training risks acquiring answers which bear little relation to the processes of skill acquisition actually used amongst Kampala mechanics. A precondition for administering questionnaires in the informal sector must be a set of unstructured pilot interviews which seek to establish some of the problems in skill development actually perceived by the petty producers themselves. The same issue of transferring formal sector categorisation to the informal sector applies to attempts to get detailed cost data on inputs, outputs, total sales per week, per month etc. It is notoriously difficult to persuade small operators, many of whom are really in subsistence self-employment, to discuss their business as if there was a thorough inventory control and separate accounts department!

7. A more policy-related question relates to a particular Kenyan informal service industry - The Nairobi Organised Mechanics Association, and the scope for any outside body offering them assistance. There have been many schemes talked of for co-opting, improving or upgrading the informal sector. (One of the more detailed accounts of the difficulties involved is contained in McCloughlin's Roadside Mechanics in Ghana.) But most schemes of assistance start with a set of assumptions about basic needs that may or may not have relevance to the artisans themselves. For example, ILO experts have talked of offering the Nairobi mechanics some of the modules of employable skill (MES) - self-teaching workbooks which treat each of the work tasks in a modular fashion. But these make assumptions about the orderly process of skill acquisition that bears little resemblance to the sequence of 'training' determined by customers demands.

Instead it would be useful for a researcher to work with the Nairobi group for some months to explore their own perecptions of what improvements are needed and are feasible. As we have implied, a research questionnaire that asks a set of closed questions about possible needs for trainee mechanics (night school, theory classes, training workshop, part-time instructors, small loans etc. etc.) is likely to produce positive requests for most of the items suggested. The more difficult task is for the researcher to study the existing technology, training and organisation, and then draw out of these some assessment of what could be changed, and what left precisely as it is. One of the NGO groups might be encouraged to do this as a small project and might aim to produce a document that was an

expansion of the technology, education and economic needs of this particular set of mechanics (70) and trainees (300).

8. Science Popularisation and Popular Science

Another main area of discussion and debate is research on science popularisation and its relation to popular science. The former tends to be organised by a government or agency, and derives from the view that a lack of basic scientific awareness is holding up rural development programmes. As such, science popularisation campaigns are part of the government's general drive for modernisation, and in one sense is the everyday extension activity of Ministries of Agriculture, Health, Water Development etc. They may, however, be run as specific one-off campaigns as with Tanzania's succession of programmes coordinated by the Institute of Adult Education: e.g. Food is Health, Forests are Wealth. Or, like Ethiopia's current planning of science popularisation, they may be run out of the Science and Technology Commission and not be focused on a particular theme. On the other side of the discussion about scientific temper, science for all, and science popularisation stands the recipient of these messages and expectations, the peasant farmer or urban-dweller. The latter have their own views of health, agriculture, child-rearing etc., and these amalgams of belief held by peasant communities have been variously termed local knowledge systems, indigenous technical knowledge, popular science, and several more. Campaigns of science popularisation presumably aim to upgrade or alter the content of these sets of beliefs.

The problem with the campaign approach is that the particular beliefs

held by peasant communities about, say, malaria, contraception, the evil eye (of blacksmiths), or the benefits of cutting a children's uvula, or cutting down trees, differ considerably from community to community, and are differentially affected by economic, religious and village pressures. Thus a campaign to have less than four children would run into different types of resistance amongst the Kikuyu in Kenya than other people, since there is a long tradition of needing to re-name the four grandparents through the children of the next generation but one. Consequently, researchers concerned with science popularisation have sought to combine an understanding of the basis of local beliefs with the dissemination of new information. There were several examples of this presented in the meeting, from Kenya and Ethiopia.

The more interactive, participatory approach assumes that there is a rationale, more or less empirically established, for peasant activities, and that understanding something of this local perspective or local knowledge is imperative to any campaign to supplant it. The alternative with some beliefs which may appear simply 'unscientific' by any criteria is to present the new without any attempt to understand the old. This happens all too often in primary school science. But if some people in Ethiopia believe, for example, that in an electric shock, the blood is taken along the wires to the eletric company, is not an approach based on a careful understanding of the original belief worthwhile? Might not a careful analysis of how the peasant thought this,reveal views about the circulation of the blood, or about electricity that might be important

in presenting information about either of these areas?

1 . The emphasis in the seminar itself was certainly more on the need for interaction between knowledge systems as the foundation for presenting new science-based information. The 1970s had taught researchers a lot about the politics of extension activities in relation to richer farmers, and about the over-used categories of early adopters, laggards etc. By contrast, dissemination of science in the 1980s was likely to be built more on an appreciation of the cultural and socio-economic obstacles to change. There was evidence of the potential of using primary science exams to disseminate critically important information about farming, health and the environment. Also in Kenya and Uganda, the scope for children's comics to deal with health, tree growing and to become an interactive instrument for tapping children's and communities' knowledge has begun to be demonstrated by Mazingira Institute. What remains is to understand more about the potential for linking informal science dissemination with the more formal processes in school.

1 . In Ethiopia, by contrast, it may be important in the research starting on science popularisation to get a feel for the richness of peasant belief systems, - not just to identify for attack those items that sound most unscientific and irrational, but also to be aware of what beliefs are grounded in folk wisdom that <u>does</u> coincide with modern science. Equally, the research attempt to document peasants' beliefs about health, sanitation and environment should perhaps particularly examine those very areas where the campaign will later place its emphasis. In this way the campaign's approach

can be to some extent based on peasant assumptions about those very topics. As with the informal sector mechanics, it may in fact be quite difficult satisfactorily to extract the degree of information needed to mount a relevant programme or a campaign. In both cases it is insufficient, in policy terms, to know that the recipient agrees or doesn't agree with a particular question. We need to know how that agreement or disagreement relates to what it is possible or feasible for the peasant (or mechanic's) economy, and also assess the ability of the state to provide the support for the more scientific approach to be advocated. None of this is meant to suggest a nostalgia or romanticism about folkways or folkmedicine. (Many beliefs about medical treatment are presumably as illfounded in parts of rural Ethiopia as they were in rural England half a century ago). Rather it is a concern that in countries where the delivery system for modern medicine is so sparse and unequally distributed, the existing indigenous system of rural medical care not be dismantled before there is a cheap widely-dispersed alternative.

13. Science Education and Science Impact

A third main area of research discussion was the current quality and impact of science education offered in primary schools, secondary schools and colleges. Among the themes of most concern were the following:

- the quality and consequences of science in the majority of poorer self-help schools;
- the impact of discovery science at primary school;
- post-school consequences of theoretical vs practical science

- exclusion of women from all but stereotyped forms of technical and vocational education
- science and creativity in situations of underdevelopment.
- new methodologies for estimating science impact

14. In the main, the discussion about the role of formal science education was more concerned about the impact of science and technology education than the question of curriculum development. This is entirely appropriate since science is very frequently promoted by governments on the grounds of what it can achieve after school. However, this area of post-school impact of science is almost completely unresearched, and the expectations for the scientific transformation of the economy are grounded on rhetoric rather than research evidence. The process of producing some of the evidence was an active concern of the meeting, as was the exploration of some of the contradictions in science education in the schools and universities themselves.

15. Primary Science: Impact on leavers and continuers

In the region Kenya has sustained the most dramatic attempt to revolutionise primary science, and for almost ten years now this revolution has been supported by the lever of exams and, more recently ,of excellent primary science texts. In combination, these have pushed schools towards limited experimentation, observation, and manipulation of data. The experience is a very powerful example of primary school examinations being used to introduce a very progressive educational reform. But although the in-school side of the reform is in place, next to nothing is

known about whether this kind of science teaching in school impacts powerfully on primary school leavers. What might be the lasting influence upon young men and women training for self-employment in agriculture or petty trade? And what foundation might it offer to the group selected to continue science through secondary school?

5. One example at the seminar indicated the possibility of science impact after school by detailed interview work with primary school leavers. The case study in question*, although it very clearly indicates the kind of channels along which inspired science teaching can affect agriculture, home and environment, was derived from the experience of a boy who had been the pupil of a very talented science teacher. Several more examples from more ordinary settings whoud need to be produced before it is possible to discuss the range of impact that might be anticipated. Furthermore, the very notion of impact itself needs to be disaggregated. Clearly, the easier impact to document is where the school teaches very specific application of science to agriculture or health, and these can be traced to the work of ex-students in their own farms or homes after leaving school. Much more problematic, however, is determination of influence when it is a matter of analysing the transfer out of school of general analytical procedures, and of cognitive styles associated with scientific method. Here again, researchers face the technical questions of how best to elicit this kind of impact information. Is science <u>knowledge</u> being put to specific use? Are the <u>methods</u> of

*K King and S Nyamwange, 'The impact of primary school science - a case study', TEED Meeting 29-31 August, 1983.

of science being applied in problem-solving?

7. Connected to this assessment of impact is the larger question of the milieu in which such utilisation might take place. Constraints on the utilisation of scienctific knowledge must range from the cultural to the political, from decisions about importing rather than adapting technology to decisions about the valuation and reward for scientific careers. The most poignant constraint must, however, be the possession of scientific knowledge by those who can find no work. This forced non-utilisation of science knowledge is a common enough occurrence in developing countries - and Eastern Africa is no exception. There is no easy recipe for translating science knowledge into productive work, and no amount of re-naming courses 'science for self-employment' will make the transition much easier.

8. There are, however, some contradictions at the heart of science teaching that could perhaps be attended to. In several countries, the science courses taken by the poorest schools are often the least practical, on the grounds that poor schools cannot afford laboratories. Meanwhile, the most practical, experimental science has been offered in those schools where it is most likely that the students will continue through 'A' levels (or equivalent) to university science. Thus, those most likely to leave school at 16 or 17, and who would be in a position to take some direct advantage of applied, practical science are almost certain not to have done practical science at all.* The very different kinds

* R Kagia 'The Quality of Education in Kenyan Secondary Schools. Quality of Science Education'. TEED Meeting 29-31 August, 1983.

of science experienced in secondary school means that great care needs to be taken in talking about the post-school consequence of taking science. In one country a very small number of science streams dominate the entry to the university's engineering school, while in many hundreds of other schools, the expectation of doing well in science is as remote as doing well in maths, and both are remote from any sense of post-school application. At the moment, however, we totally lack a detailed picture of what science looks like in ordinary schools; what standards are reached and lessons learnt despite the exam grades. We know the reality is very different from the international rhetoric about "investing in science", but painstaking qualitative studies will have to be done to unravel the dimensions of the problem.

9. Similarly with girls' participation in science, maths and technology. It is comparatively easy to document the progressive exclusion (or self-exclusion) of girls from science, maths and technology as they go further up the school and college system; but a very different kind of research is needed to unravel the mix of cultural, socio-economic and attitudinal factors that impinge on girls' perceptions of subjects and careers from primary school, and even earlier. Certainly, in Kenya by the end of primary, girls are doing markedly less well than boys in particular kinds of science questions. But much more item analysis would be required, as well as parallel research in other aspects of primary school (and home) experience before the differential performance of girls can be understood, and then policy decisions clarified about their improvement.*

*Current work by George Eshiwani, and work being planned by Esther Keino are both concerned with this issue in Kenya.

20. Science, Manpower Analysis and New Technologies

Another major theme at the seminar was the work that could be done in sorting out actual patterns of utilisation of scientists and technically trained workers in industry and in agriculture. Several countries have sought to work out their 'science potential' through studying numbers of different kinds of scientifically trained personnel. Such studies inevitably face the very problems of estimating utilisation of these skills that this seminar was concerned with. In the case of the two research reports from Kenya, it soon became clear that the technical research questions surrounding the categorisation of manpower were almost inextricably entangled with the conceptual questions.

21. For example, one of the studies sought to estimate total numbers of scientist, technician and artisan in Kenya.* It soon became clear that this threefold classification is very difficult to apply outside certain kinds of highly organised industry, and parastatal, and even in large firms, individuals often do technician-level work without technician qualifications. In non-industrial services, however, it is virtually impossible to decide on artisan or technician equivalents. Is a nurse, a primary school teacher, a veterinary assistant or an agricultural extension officer in any sense an artisan or a technician? The terms are really not satisfactory to categorise the bulk of the skilled or professional workers in Kenya.

2. Equally in manufacturing industry, firms may have skilled workers

*Jasper Mani, National Council for Science and Technology, TEED Meeting 29-31 August 1983.

but they may not be certified, or they may have certified workers (e.g. with government trade tests) who are not doing skilled jobs. In both cases it may be important to draw a distinction between skill level and its utilisation. Other firms again will use their own in-house classification systems. They may or may not use the term artisan or technician, and even if they do, may not use either term in ways that correspond with the definitions used by the survey's researchers. Kenya Railways, for example, may use the term artisan in a much more restricted way than other enterprises. Even more problematic, firms may not use the term technician at all, but will talk of junior supervisors. That is to say, enterprises may emphasise distinctions of management and supervision where the survey is based on distinctions of technical and scientific knowledge. Thus supervisors of artisans may not have formal technician qualifications at all.

3. All this suggests that surveys designed to analyse national manpower according to a particular range of categories are going to be extraordinarily difficult to execute. Even when questions are asked of the individual worker rather than the personnel manager or owner, it may be difficult for the person collecting the data accurately to assess the value of what he or she is told. If the medium of the interview is for example, Swahili, the worker may admit to being a <u>fundi</u>, a general term for being a skilled man. But <u>fundi</u> can be used colloquially to cover a much wider range of competence than the various categories in English: skilled, semi-skilled, time-served etc. etc. Hence there is a very critical translation job to be done by the person collecting the data, as well as an equally

demanding job in transferring the job descriptions into the numerical codes used in labour classification. Thus if the coding clerks categorise as an engineering code the term "telecommunications engineer" (as used by the Posts and Telecommunications to describe a skilled maintenance man who has never been near an engineering faculty), then Kenya can end up with several thousand more 'engineers' than she actually possesses.

24. This kind of research may seem to be hair-splitting, but in reality it does have important policy implications. There are a series of continuing arguments about the actual needs of an underdeveloped country for different kinds of manpower. Does Kenya or Ugnada need more polytechnics? Which are in short supply - engineers, technicians or skilled workers? At the moment, there is very little than can be termed solid research on the relationship between the demands of the installed technology, or the requirements of the work of a Ministry on the other hand, and the profile of skills and knowledge on the other. Thus, the Vice-Chancellor of Nairobi University frequently talks of Kenya having an "inverted pyramid" of knowledge with too many engineers at the top, too few technicians in the middle and far too few skilled artisans at the bottom. But this like its opposite, the allegedly vital international rates of 1 engineer to 5 technicians to 20 or more skilled workers, is not based on any empirical work in Eastern Africa.

25. Accordingly, some very timely studies could look at the needs of the public sector, industry and agriculture as presently met by trained and untrained labour, and estimate the very complex set of

influences altering the composition of those different labour forces. Amongst these would certainly be the following: technological changes in the North; certificate escalation fed by higher levels of unemployment; government pressure to develop polytechnical training, and to employ its products; requirements of productivity and competitiveness. It is likely that just as in Britain, France and Germany there are very different mixes of skill and knowledge in the workforce for very similar kinds of production, so in Eastern Africa, there are probably already evident patterns of labour force use which are by no means determined by the technology. Possibly the next generation of studies will take different industrial and agricultural settings and examine the rationales of labour utilisation.

26. One important dimension of these changing patterns must be the continuing impact of foreign aid upon technical and technological training provision. Although only one ingredient in the mix, it is nevertheless a crucial one. Such aid projects are of course only too frequently evaluated, but not researched for their impact upon wider training styles, and upon labour utilisation. Examples of these are many, but amongst those that might profitably be researched at this stage are the Kenyan variety of ILO's 'modules of employable skills' programme. This highly complex system for job specification, skill analysis and module development has not been examined, but materials have already begun to be developed in Kenya and it would be appropriate for a small research study to be mounted on the relevance of this modularised training package in Kenya. In other parts of East Africa, foreign aid has brought in different education and training approaches. Currently some of

these are being researched in Tanzania*, but several others could be examined in ways that could shed light not just on the innovation as an education and training initiative, but also on its relationships with technology and with the workplace.

Computer Education

A last example of education and new technology to be discussed at the seminar was the recent intervention of computer education into East African Schools. The first examples of what may become a much larger invasion are in Kenya - in the Aga Khan Academy, the famous Starehe School, and the first pre-independence interracial primary school, Hospital Hill. German aid has been instrumental in bringing 30 micro computers into Starehe, and the Aga Khan Foundation a smaller number to the Academy.**

In the latter case, the intention is to monitor very carefully the impact of the introduction. This is likely perhaps to be more concerned with the nuts and bolts of implementation and action, and less interested in the wider social and political sides of the innovation. Educational researchers need to be alive to both the process questions implied in the optimism about the learning impact of "micros" in schools as well as the larger issues of the education system preparing students for the information revolution being imported from developed countries.

As with the case of educational TV in the Ivory Coast (finally closed down by the government in recent months), so now with this

*R Meena, paper at TEED Meeting 29-31 August 1983.
**B. Wray, 'Computers in Education, A Kenyan Pilot Experience',TEED Meeting 29-31 August 1983.

generation of educational innovation, the talk is of the need for East Africa not to be left behind - even of the possibility of leapfrogging stages of information-processing which took decades for the North to pass through. It is, finally argued that computer education is inevitable, since the computerised office has already reached East Africa, consulting firms already own many mini-computers and are conspicuously using the first graduates of computer education from Starehe. Even if there are worries about the computer saturation of a Senegalese village by a French experiment in information leap-frogging, surely, it is argued,these more ordinary manifestations of computer awareness are essential if East Africa is going to have its own computer scientists. Hence the familiar policy dilemma for poorer countries: damned (and dependent) if you do, damned (and more dependent) if you don't.

In this situation as with many previous innovations, the experimental programme has started far in advance of local researchers being able to analyse and comment on the options. But even now it would seem highly appropriate for some very focused research to map out the options and the implications for the Ministry of Education, for different kinds of schools, and for rural and urban equity.

Researching Science, Technology and Education. The Role of Networks

Attention to the interconnections in Eastern and Southern Africa amongst technology, education and employment issues is already producing a research agenda which many different disciplines could profitably contribute to. To be effective, any such integrated programme will need to draw on strengths from sociology, science

studies, political economy, technology policy economics, engineering, agriculture and, of course, education. Such a composition has been evident in the first two meetings of the TEED network. It is also beginning to be reflected in the first suggestions for research studies. However, if the insights available across this inter-disciplinary area are to become genuinely interactive, then a mechanism is needed which makes these interconnections part of a more dynamic collaboration than is possible through the funding of seven or eight studies scattered across sector, discipline and country.

One of the responses to the question of evolving multi-sectoral studies around specific problems was that teams of researchers, reflecting various facets of a research issue, come together. Another was co-ordination and exchange between researchers. The meeting recommended the development of national working groups for setting priorities for research in their region, and researchers, educators, and policy-makers establishing co-ordination amongst themselves and others interested in the TEED issues. The kinds of networks to be formed could be decided upon by the national groups, emphasis on different types of research would be reflected in the membership, the patterm of meetings, dissemination of results etc. The initiation of such networks could be done by either the participants of the workshop or any one else interested.

In any networking related to TEED, there would be the possibility of receiving from IDRC relevant publications on technology and education, as well as organising small national meetings around

visiting researchers from elsewhere in the region. The initial rationale for such meetings would be, however, to offer an opportunity for countries other than Kenya (where the first two meetings have been held) to discuss the relevance of the TEED ideas to different members of their own research community. Thus far, only one or two researchers from each of the neighbouring countries have been able to attend compared to some 20 researchers from Kenya. Ideally therefore IDRC will encourage smaller national meetings at which the TEED coordinator will be present and where some of the TEED overview documents and reports can provide an initial impetus for discussion. Among documents that would be suitable would be:

1. Science, Technology and Education Research in Eastern Africa (K King) Oct, 1982.

2. Science, Technology and Education in Eastern Africa: Report of an IDRC Workshop, Nairobi 10-12 Jan, 1983.

3. New Approaches to the Analysis of Scientific, Technological and Skilled Manpower. (K King) March, 1983.

4. Technology, Education and Employment for Development (TEED) Technical Workshop Report, Nairobi, 29-31 Aug,1983.

As mentioned above, one outcome of such workshops could be identification of research problems, which could in turn be discussed directly with the TEED coordinator in IDRC's Regional Office for

Eastern and Southern Africa. Also available from the TEED Coordinator are descriptions of the type of research support IDRC expects to make available to researchers interested in exploring some particular theme in this multidisciplinary area.

For inquiries about the TEED Workshops, seminar papers, or possibilities for research funding, please write to or communicate with the TEED Coordinator:

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List of papers and presentations at TEED Technical Workshop

Nairobi August 1983

Susan Minae	-	Educational and Training Problems or Issues Associated with Transfer of New Technology in Agriculture.
Ruth Kagia	-	The Quality of Education in Kenyan Secondary Schools; Quality of Science Education
Alex Berluti	-	Elementary Technology in Primary Schools
K King and Nyamwange	-	The impact of primary school science - a case study
K King	-	New Approaches to the Analysis of Scientific, Technological and Skilled Manpower.
Brian Wray	-	Computers in Education, A Kenyan Pilot Experience
Ruth Meena	-	Problems Experienced in Researching on Impact of Foreign Aid on Educational System in Tanzania. Preliminary findings and their implications to the general trends in Educational Development.
Davinder Lamba	-	Involving Rural Children in Environment and Development Issues: A Case Study from Kenya

C C Mutambirwa - The Informal Manufacturing Sector in an Industrialising Economy, The Case of Zimbabwe

G Nyangasi - The batch produc tion engineering factory: the work tasks that call for learning by doing within the enterprise

Jasper Mani - Counting Scientists, Technicians and Artisans in Kenya - Conceptual Problems

E Keino - Opportunities for females in technical training in Kenya: A focus on the primary, secondary and post-secondary levels of training.

J N Odurkene - Indigenous Apprenticeship and Informal on-the-job Training Practices in Uganda.

Research Methodologies, Concepts and Issues relating to the Informal Sector

Kebbede Tiku - A Rationale for Science Popularization

Y Omar Ali - to be circulated.

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